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STUDY OUTLINE

"REMOTE SENSING FOR THE MINISTRY OF THE ENVIRONMENT"

Prepared by
MOE's Remote Sensing Committee

January, 1981

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environment" /
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STUDY OUTLINE

"REMOTE SENSING FOR THE MINISTRY OF THE ENVIRONMENT"

Prepared by
MOE's Remote Sensing Committee

January, 1981

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SUMMARY

A Remote Sensing Committee was established to prepare a Study Outline dealing with the utility of remote sensing techniques to MOE's programs. The Committee consisted of representatives from the Ontario Centre for Remote Sensing, the Ministry of Transportation and Communications and MOE's Regional Operations and Head Office.

The Committee has verified the need to examine the application of remote sensing techniques to the programs of the Ministry of the Environment. Three tasks have been identified for this purpose. Two tasks are suitable for immediate implementation. The third task is suitable for long-term implementation. The three tasks are:

Immediate Tasks

1. Apply existing remote sensing techniques to an on-going MOE program.

2. Review present situation for using remote sensing in MOE and introduce the techniques to additional program areas.

Long-Term Task

3. Document the state-of-the-art applications of remote sensing techniques to MOE's programs and conduct relevant research.

The Study Outline provides more information on the activities required to complete the immediate tasks. It is optimistically estimated that a minimum of 32 man/days of Head Office staff time and 14 man/days of Regional Operations staff time would be required to complete the case study for Task 1. For Task 2, a minimum of 3-4 months would be required to survey and catalogue the data requirements for MOE's programs and the resources available (equipment and personnel) within MOE. Additional staff time would be required to assess the benefits and costs of applying remote sensing to MOE's programs in order to complete Task 2.

A more general framework is presented for the long-term task. It provides a guide for conducting research on the application of potential remote sensing techniques to MOE's programs. A proposal to complete this task has been prepared by the Ontario Centre for Remote Sensing and is appended to this Study Outline. However, the Remote Sensing Committee does not endorse the proposal at this time, because MOE's requirements should be clearly defined first and greater detail is necessary.

Flexibility in choosing a course of action for doing the tasks and activities is incorporated in this Study Outline. It is recommended that Tasks 1 and 2 proceed concurrently, in the near future and that Task 3 proceed when Task 2 is completed, or when MOE's requirements are clearly defined.

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SECTION I
BACKGROUND

INTRODUCTION

The Ministry of the Environment is responsible for ensuring a safe and healthy environment. However, this responsibility is becoming increasingly difficult to fulfill. The complexity of environmental problems is one aspect. However, this is compounded by the number of potential problems and the size of the area over which MOE must maintain a vigilance. In addition, fiscal constraints require that the responsibilities for environmental protection be performed effectively and efficiently.

In order to increase the effectiveness and efficiency of MOE's programs and to gain control of new environmental problems, developments in existing and new technology are being examined. Remote sensing* technology appears to have some potential to assist in overcoming environmental management problems.

On November 26, 1980, the subject of remote sensing was discussed at a meeting of the Directors, Regional Operations and Laboratories Division. The discussions indicated that remote sensing techniques can be applied immediately to some programs of the Ministry of the Environment and that its potential application to other programs should be explored. Subsequently, field staff also reinforced the need to examine the potential of remote sensing techniques.

At Mr. Bidell's request, a committee was organized to prepare a "Study Outline" dealing with the utility of remote sensing techniques for MOE. The following people are members of the Remote Sensing Committee:

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* Refer to Appendix 2 for definitions.

Mr. David Dalman, MOE, Environmental Approvals Branch (Chairman)
Dr. Simsek Pala, MNR, Ontario Centre for Remote Sensing
Mr. Lawton Tam, MTC, Remote Sensing Section
Mr. Darryl Hogg, MOE, Central Region
Mr. Roger Howe, MOE, West-Central Region
Mr. Ron Johnson, MOE, Information Services Branch

PURPOSE

The purpose of the Remote Sensing Committee is to prepare a "Study Outline" dealing with the utility of remote sensing techniques for MOE. The Outline identifies the tasks and activities required to clarify the contribution which remote sensing techniques can make to MOE's programs and to implement the effective use of these techniques.

The Outline will assist senior management in selecting and assigning the tasks and phasing the activities which can lead to a strategy for the use, education and organization of remote sensing in MOE.

METHOD

The Study Outline is a cumulation of discussions held during the Remote Sensing Committee meetings. The tasks presented rely on the perceived requirements of both Head Office and Regional Operations, and draws upon MTC's experience with operational remote sensing programs.

The Outline is designed to provide flexibility in selecting a course of action. The Committee has included more specific information on the immediate tasks. In the case of the long term task, only a general framework is discussed.

The Ontario Centre for Remote Sensing has prepared for MOE's consideration, a proposal dealing with the long term task. As agreed, their proposal is included with this Study Outline. However, the OCRS proposal does not contain sufficient detail upon which to base a decision for such a large undertaking. In addition, MOE needs to clearly define its program requirements before details are requested. Consequently, the proposal is not endorsed at this time.

ASSUMPTIONS

The following assumptions have been made:

- remote sensing applications are unknown or under-utilized for MOE programs. (Appendix 2 discusses the levels of remote sensing and Figure 3 illustrates the probable level of use of remote sensing in MOE);
- the existing capabilities for using remote sensing within MOE are not fully known; and
- the benefits and costs of remote sensing applied to MOE's environmental concerns have not been assessed.

SECTION II
SUMMARY OF TASKS

The Remote Sensing Committee has identified three major tasks which should be pursued to evaluate and implement the use of remote sensing techniques. Two of the tasks are suitable for immediate application. The third task considers the long-term aspects of applying remote sensing techniques to MOE's programs. A summary of the three tasks and the major activities follows. Refer to Appendix 1 for a description of the tasks.

Immediate Tasks

1. Apply existing remote sensing techniques to an on-going MOE program;

   - select a program/project;
   - conduct case study;
   - review experience and implement.

2. Review present situation for using remote sensing in MOE and increase the application of the techniques to additional program areas;

   - survey and catalogue existing utilization of and available resources for remote sensing in MOE;
   - identify MOE's program requirements;
   - introduce remote sensing to additional program areas and ensure maximum benefit to MOE through full utilization of remote sensing resources.

Long-Term Task

3. Document the state-of-the-art applications of remote sensing techniques to MOE's programs and conduct relevant research;

   - document the state-of-the-art;
   - identify research needs and conduct relevant research;
   - prepare Handbook.

SECTION III
IMPLEMENTATION

Figure 1 is a flow chart summarizing the overall process for the tasks and the decision points. After the Study Outline is approved, detailed procedures for performing the 3 tasks should be prepared to enable the work to be carried out.

The Outline is structured to be flexible. It can be accepted or rejected in whole or in part. If required, certain activities can be performed independently without reference to the particular task in question, although this may not be advisable. Start-up of the tasks and staging of the activities are also flexible. In addition, the nature of some of the activities themselves is such that there is considerable choice in assigning the work (Refer to "Options for Work Assignment and Resource Requirements, Appendix 1).

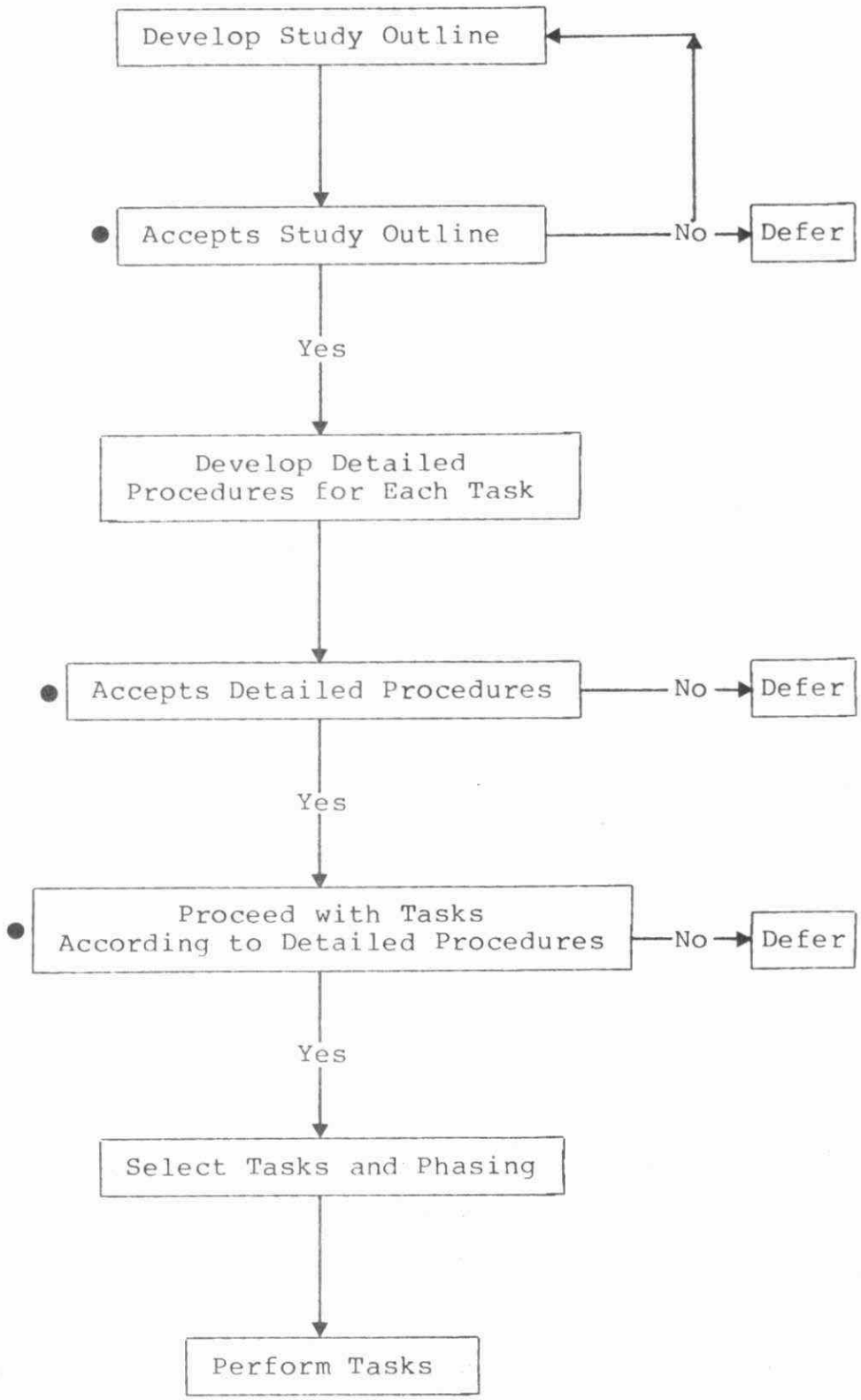
The tasks can be performed in the sequence as presented in Figure 2 or in various combinations (i.e. two or three tasks can progress concurrently). The options for performing the tasks are:

(1) Task 1 only;
(2) Tasks 1 and 2 concurrently, then Task 3;
(3) Task 2 only,
(4) Task 2, then Task 3;
(5) Tasks 1 , 2 and 3 sequentially.

Figure 2 is a flow chart for one option (performing Tasks 1, 2 and 3 sequentially) illustrating the work stages and decision points involved.

FIGURE 1

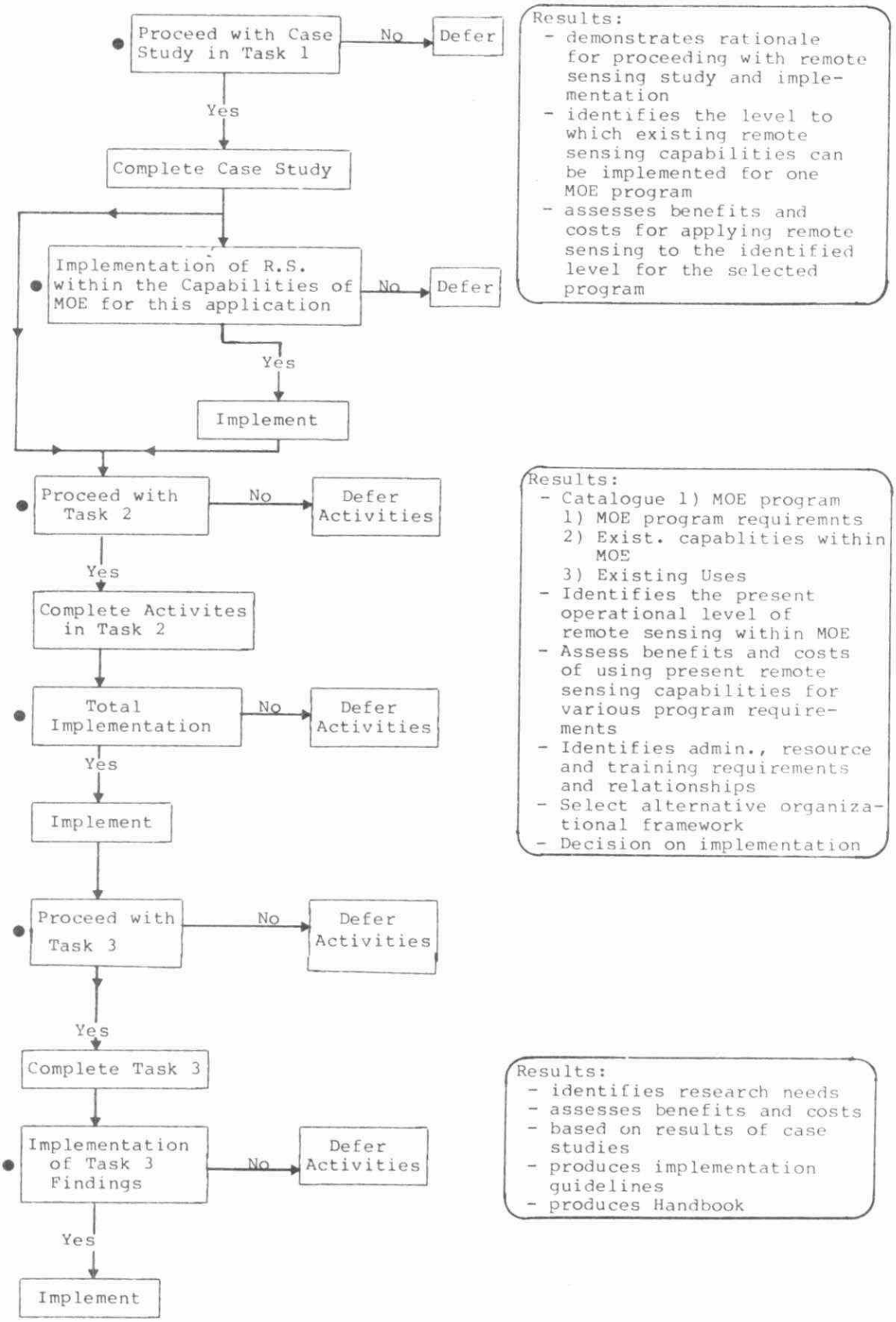
GENERAL FLOW CHART



● Indicates a decision point

FIGURE 2

"FLOW CHART FOR PERFORMING TASKS SEQUENTIALLY"


Proceed with Case Study in Task 1
No
Defer
Yes
Complete Case Study
Implementation of R.S. within the Capabilities of MOE for this application
No
Defer
Yes
Implement
Proceed with Task 2
No
Defer Activities
Yes
Complete Activites in Task 2
Total Implementation
No
Defer Activities
Yes
Implement
Proceed with Task 3
No
Defer Activities
Yes
Complete Task 3
Implementation of Task 3 Findings
No
Defer Activities
Yes
Implement
Results:
- demonstrates rationale for proceeding with remote sensing study and implementation
- identifies the level to which existing remote sensing capabilities can be implemented for one MOE program
- assesses benefits and costs for applying remote sensing to the identified level for the selected program
Results:
- Catalogue 1) MOE program
1) MOE program requiremnts
2) Exist. capablities within MOE
3) Existing Uses
- Identifies the present operational level of remote sensing within MOE
- Assess benefits and costs of using present remote sensing capabilities for various program requirements
- Identifies admin., resource and training requirements and relationships
- Select alternative organizational framework
- Decision on implementation
Results:
- identifies research needs
- assesses benefits and costs
- based on results of case studies
- produces implementation guidelines
- produces Handbook

● Indicates a decision point

In implementing this Study Outline, a decision is required not only on which Task(s) should be performed first, but also on work assignments. These two considerations will affect resource requirements. Work can be assigned in five separate ways. These include MOE Head Office and/or Regional Operations staff, MOE Task Force or Committee, another government agency (e.g., OCRS), universities, or consultants.

Recommendations:

It is evident from this Study Outline that there are numerous alternatives for performing the tasks. It will be beneficial for MOE if any of the tasks or activities are completed. However, it is recommended that:

1. MOE proceed with Tasks 1 and 2 concurrently, in the near future; and,

2. MOE proceed with Task 3 when Task 2 is completed or when MOE's requirements are clearly defined.

A P P E N D I X 1

APPENDIX 1
DESCRIPTION OF TASKS

TASK 1: Apply Existing Remote Sensing Techniques

Purpose

The reasons for applying existing remote sensing techniques to an ongoing MOE program are:

1) to identify the level to which existing remote sensing techniques can be implemented for one MOE program;

2) to demonstrate the utility of remote sensing and provide a rationale for considering remote sensing techniques further;

3) to gain experience in its application and identify any operational requirements peculiar to MOE;

4) to assess the costs and benefits of using this technology for the application selected; and,

5) to contribute to the resolution of an immediate MOE concern.

Criteria

The criteria for selecting the program include the following:

- proven operational remote sensing capabilities must be available;
- MOE program of common concern to all Regions;
- high level of public and MOE concern; and
- readily available site(s) for case study.

Ideally, the program should be selected jointly by senior management in conjunction with those assigned to the task.

Activities

The following activities are required to complete Task 1:

1. Select a program/project;

2. Identify requirements of the selected program (e.g., type of data, level of detail, tolerances, time constraints);

3. Survey available operational remote sensing techniques;

4. Analyze potential benefits and costs;

5. Develop procedure for application;

6. Conduct case study and evaluate actual benefits and costs;

7. Finalize procedures for application;

8. Implement

   (a) utilization by regions
   (b) feedback
   (c) monitor actual benefits and costs
   (d) make revisions and report

Options for Work Assignments and Resource Requirements

Table 1 indicates the activities and possible options for work assignments. Table 2 shows the resource requirements assuming tht only MOE's Head Office and Regions will be involved. Additional time would be required to include the advice of a committee or task force. It should be noted that an optimistic the estimate of 32 man/days of Head Office time and 14 man/days of Regional Office time (Table 2) is for one site. Operating expenses have not been estimated. This will depend upon the project selected, the geographical location and the extent and diversity of the sites/areas.

TABLE 1

POSSIBLE WORK ASSIGNMENTS, TASK 1

Activities	Performed By
1. Select program/project	A and B/C
2. Identify requirements of program	B/C
3. Identify available operational RS techniques	C/D/E
4. Analyze potential cost-benefits	C/D/E
5. Develop procedures for application	C/D/E
6. Implementation	B/C

Legend of Possible Sources:

A. MOE senior management

B. MOE Head Office and/or Regional Operations staff

C. MOE Task Force or Committee

D. Other government agencies (e.g., OCRS)

E. Consultants

TABLE 2

ESTIMATED RESOURCE REQUIREMENTS, TASK 1

Activity	Resource Requirements (man/days)	
	Head Office	Regional Office
1. Select program/project	1	-
2. Identify requirements of program	2	1
3. Survey operational remote sensing techniques (considering capability, availability, special requirements, cost)	6	-
4. Analyze potential benefits and costs	5	-
5. Develop procedures for application	3	1
6. Conduct case study and evaluate actual benefits and costs	9	9
7. Finalize procedures for application	2	1
8. Contingency	4	2
	TOTAL 32 man/days	14 man/days

TASK 2: Review Remote Sensing Situation

Purpose

The reasons for reviewing the present situation for using remote sensing in MOE and introducing the techniques to additional program areas are:

1. to identify the present operational level of remote sensing capabilities within MOE;
2. to assess the benefits and costs of using present remote sensing capabilities;
3. to ensure the maximum benefit to MOE of existing remote sensing resources by introducing the techniques to under-utilized areas.

Activities

The activities required to accomplish this task include the following:

1. Survey technical requirements of MOE programs;
2. Survey and catalogue existing MOE utilization, capabilities and capacities for using remote sensing techniques (Table 3 identifies how this information could be compiled in activities 1 and 2);
3. Analyze and document previous remote sensing experiences of MOE including successes and failures;
4. Match existing requirements with existing capabilities and capacities to ensure full utilization of beneficial applications;
5. Identify potential benefits and costs;
6. Re-affirm existing uses of remote sensing techniques;
7. Prepare guidelines for basic applications of remote sensing techniques;
8. Introduce additional under-utlized applications to achieve the basic level of use;
9. Identify any additional operational remote sensing techniques;

TABLE 3

MOE Program	Information Needs/ Data Requirements	Remote Sensors Presently Used by MOE	MOE Staff Presently Using Remotely Sensed Data
Illegal Disposal of Hauled Liquid Industrial Waste	24-Hour Surveillance of: Generators - - Haulers - - Storage/Transfer Facilities - - Disposal Sites -	Aerial photography Time Lapse Other Sensors	

10. Develop technical procedures for utilization of remote sensing techniques to the operational level;

11. assess organizational needs including administrative, resources (equipment/personnel), and training to ensure the feasibility of using remote sensing to the full operation level; and

12. implement of remote sensing techniques to full capabilities at MOE.

Options for Work Assignments and Resource Requirements

Similar to Table 1, Table 4 indicates the activities and possible options for assigning work. In this case, however, no attempt was made to identify resource requirements. A considerable effort will be required to complete this important task. It could be estimated that a minimum of 3-4 months work would be necessary. More details are required to accurately estimate the resource requirements. Also, the completion of Task 1 will provide a more factual basis for making estimates.

TASK 3: Document State-of-the-Art and Conduct Research

Purpose

The reason for documenting the state of the art of remote sensing applications is to permit full knowledge of the environmental management applications of remote sensing techniques. This is a long term task, envisaged to extend over a number of years. It will establish the state-of-the-art for remote sensing techniques, and investigate, conclusively, areas of potential application. Where a potential application proves feasible, operational procedures will be developed for implementation. Subsequent to the research, a Handbook will be prepared for use by MOE staff.

TABLE 4

POSSIBLE WORK ASSIGNMENTS, TASK 2

Activities	Performed By
1. Survey technical requirements of MOE programs	B/C/D/E
2. Survey and catalogue existing MOE utilization capacities for using remote sensing techniques	B/C/D/E
3. Analyze and document previous remote sensing experiences of MOE including successes and failures	B/C
4. Match existing requirements with existing capabilities and capacities to ensure full utilization of beneficial applications	B/C/D/E
5. Identify potential benefits and costs	B/C/D/E
6. Re-affirm existing uses of remote sensing techniques.	A
7. Prepare guidelines for basic applications of remote sensing techniques	B/C/D/E
8. Introduce additional under-utilized applications to achieve the basic level of use	A and B
9. Identify any additional operational remote sensing techniques	B/C/D/E
10. Develop technical procedures for utilization of remote sensing techniques to the full operational level	B/C/D/E
11. Assess organizational needs including administrative, resources (equipment/ personnel), and training to ensure the feasibility of using remote sensing to the full operational level; and	A (detailed work can be assigned to others)
12. Implement remote sensing techniques to full capabilities of MOE	A and B

Legend of Possible Sources:

A. MOE senior management
B. MOE Head Office and/or Regional Operations staff
C. MOE Task Force or Committee
D. Other government agencies (e.g., OCRS)
E. Consultants

Activities

The following activities are required to accomplish this task:

1. prepare comprehensive catalogue of remote sensing techniques and data requirements. This step would be an expansion of the first step under Task 2, mainly in the area of remote sensors.

2. identify research needs.

3. conduct investigations using potentially feasible sensors and/or techniques

   - select sensors and/or techniques
   - identify test site(s)
   - data acquisition and analysis
   - ground truth
   - evaluate and report

4. develop procedures for application.

5. prepare Handbook.

6. implement newly developed remote sensing techniques.

Options for Work Assignments

There are a number of options for assigning work to complete Task 3. These include performing the research "in-house", using a combination of MOE Head Office and Regional Operations experts (or by a Task Force or Committee); or performing the research externally using a government agency such as OCRS, a consultant, or a university.

A proposal dealing with Task 3, prepared by the Ontario Centre for Remote Sensing is included in Appendix 3. This proposal is one of several alternatives for completing Task 3 using external resources. The OCRS proposal does not contain sufficient detail upon which to base a decision for such a large undertaking. In addition, before greater detail is requested, MOE's requirements should be clearly defined. Therefore, the Committee is not prepared to endorse the OCRS proposal at this time.

APPENDIX 2

APPENDIX 2

Definitions and Description of Levels for Using Remote Sensing

The terms remote sensing, aerial photgraphy and aerial photographic interpretation are often confused. Specifically, remote sensing is the gathering of information about objects from a distance. Aerial photography is the most commonly used type of remote sensing technique for data acquisition. Aerial photographic interpretation (API) is the act of examining photographs to identify objects and determine their significance. API is considered to be a remote sensing technique which translates remotely sensed data into useable information.

In applying remote sensing, 2 general levels of use can be distinguished:

(1) Basic level and (2) fully operational (or state-of-the-art) level.

(1) Basic Level:

Performing simple tasks such as reading airphotos (as distinguished from analyzing and interpreting airphotos) for routine identification of objects, features and phenomena. Work at this level can be done by many people fairly easily, after some "hands-on experience" or training. In having staff work within this level, there will be a minimum of preparation, training and disruption of regular work and also a minimum of disruption in available equipment. However, only a small proportion of the available capabilities (and therefore advantages) of remote sensing are utilized.

(2) Fully Operational Level:

Work within this level extends the use of remote sensing beyond the basic level. It requires analysis and interpretation (as distinctive from "reading") of airphotos and imagery to study features and conditions to the limit of the capabilities presently available. The work requires personnel who are knowledgeable in remote sensing and may require sophisticated equipment or instruments. In general, achievement of this level of use depends upon the education, experience and interest of the practitioner.

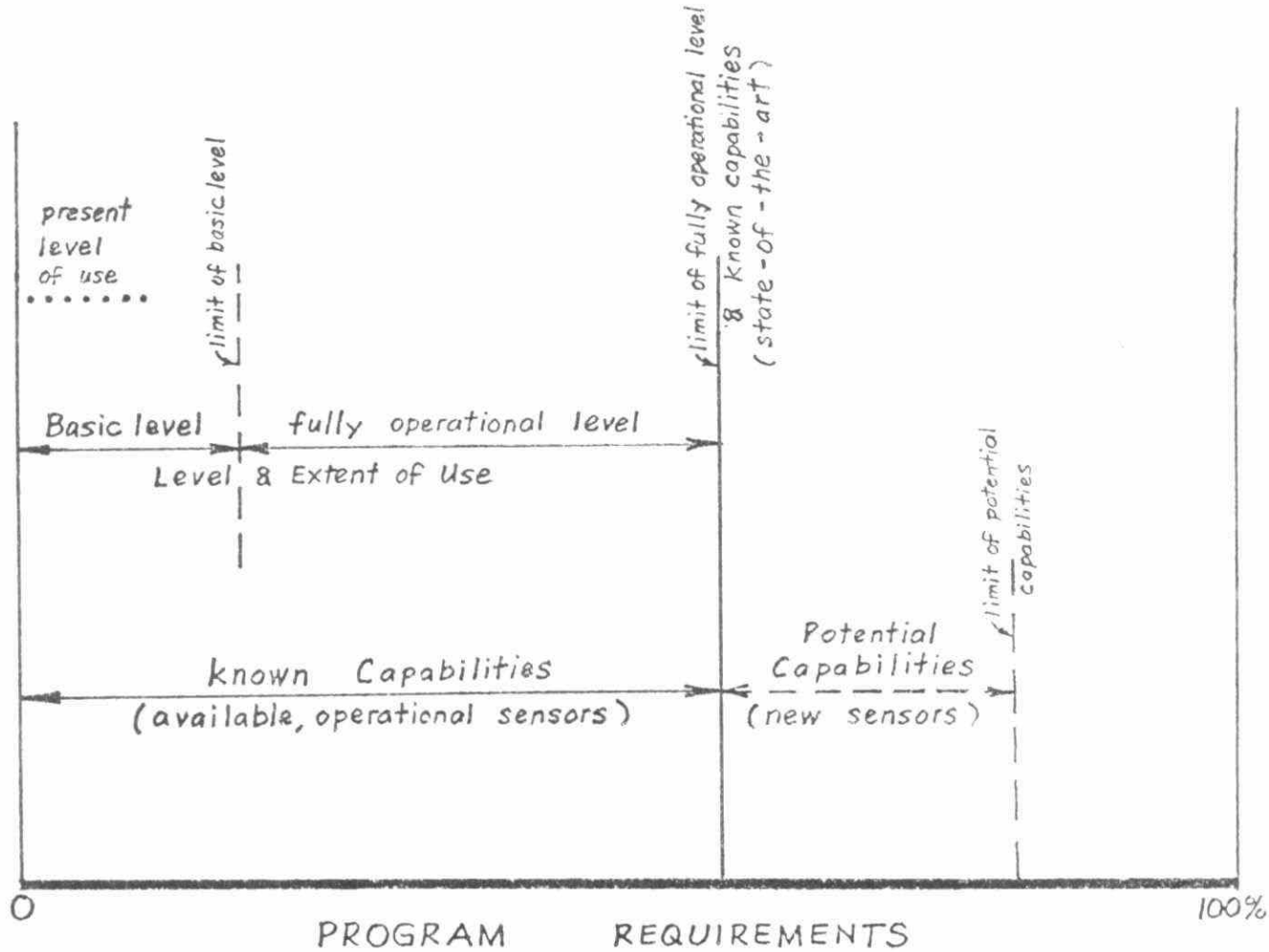
In using remote sensing at this level, availability of resources is more critical. Staff should be carefully selected and extensive training may be necessary. Support services (such as a source of airphotos and imagery) may also be required.

It is expected, at present, that the general level of use of remote sensing techniques in the Ministry of the Environment is somewhere below the basic level. Figure 1 illustrates the relationship between different levels of use.

FIGURE 3

REMOTE SENSING APPLICATION TO PROGRAM REQUIREMENTS

(HYPOTHETICAL)



APPENDIX 3

Ministry of
Natural
Resources

Ontario

Your file:

1981-01-20 Our file:

MEMORANDUM TO:

Mr. D.W. Dalman
Chairman
Remote Sensing Committee
Ministry of the Environment
Land-Use Co-ordination and
Special Studies Section
10th Floor
135, St. Clair Ave. West
Toronto, Ontario
M4V 1P5

Subject: A Proposal for Establishment of Remote Sensing Techniques and Methodologies for Environmental Monitoring and Impact Assessment Programs

At the request of Mr. J.W. Giles, Assistant Deputy Minister, Ministry of the Environment, we are pleased to enclose the above proposal for consideration by the Ministry.

We understand that if this proposal is accepted the Centre would put it into effect in close co-operation with the Remote Sensing Committee.

Your early response would be appreciated.

Victor Zsilinszky,
Associate Director
i/c O.C.R.S.

S.Pala:ets
Enc.
cc: J.W. Giles
M.F. Walmsley
R.G. Code

A PROPOSAL FOR ESTABLISHMENT OF REMOTE SENSING TECHNIQUES AND METHODOLOGIES FOR ENVIRONMENTAL MONITORING AND IMPACT ASSESSMENT PROGRAMS

Prepared for the

MINISTRY OF THE ENVIRONMENT

by the

ONTARIO CENTRE FOR REMOTE SENSING

Surveys & Mapping Branch
Ministry of Natural Resources
3rd Floor, 880 Bay Street
Toronto, Ontario, M5S 1Z8

January, 1981

A PROPOSAL FOR ESTABLISHMENT OF REMOTE SENSING TECHNIQUES AND METHODOLOGIES FOR ENVIRONMENTAL MONITORING AND IMPACT ASSESSMENT PROGRAMS

REASONS FOR THIS PROPOSAL

With the growing technological developments in remote sensing new sensors are available which should be fully explored. They are providing information regarding the environment for which application areas should be established. Every program related to monitoring of the environment could benefit from the output from one or more of these new sensors. Because of the newness of this technology, however, not all potential users in government and the private sector are aware of its capabilities and limitations.

It is often the case that when a new study area is being considered, decisions are made to experiment with the data from new sensors without any positive knowledge of a sensor's capabilities for any given application. It can cost thousands of dollars just to test one sensor which may ultimately prove useless for a particular application. Consequently, if regions investigate the capabilities of different sensors for various purposes independently and without any prior knowledge of their suitability, unnecessary expenditure of funds is incurred in those instances where the sensor proves unsuitable for the application required. Because such failures are not normally publicized, others are unaware of the pitfalls ahead when they get a similar idea. In some cases, departments may be advised to investigate two or

....2

three sensors for the same program and it may transpire that all the sensors provide the same level of information. Prior awareness of each sensor's suitability for certain applications would eliminate the unnecessary use of funds for an expensive, multi-sensor operation.

AREAS TO BE RESEARCHED

Those environmental concerns which may require investigation will be established by the regional offices of the Ministry of the Environment and communicated to the Remote Sensing Committee. The following areas are those which the Ontario Centre for Remote Sensing (OCRS) suggests should be investigated by them with a view to establishing the limitations and the capabilities of the new sensors:

1. Waste Disposal Sites
   (a) Site Selection
   (b) Monitoring (during and after the fill)
2. Nuclear Power Station Site Selection and Monitoring
3. Industrial Fume Damage Monitoring
4. Acid Rain Monitoring
5. Urban and Suburban Development Monitoring
6. Fossil Fuel Site Monitoring (peat, coal)
7. Monitoring of Mine Tailings
8. Road Site Selection and Monitoring
9. Detection of Oil Spills and Monitoring of Discharge of Industrial Liquid Waste

....3

10. Monitoring of Hydro Dams and Diversions

11. Agricultural Damage Assessment

12. Ice-jam and Snow-melt Monitoring

Priorities for investigation will be set by the Ministry of the Environment but the OCRS may begin preliminary work on all the investigations at the same time to establish data requirements and obtain the seasonal imagery necessary.

PROCEDURES

For each investigation, the Centre will first establish which sensors might be of assistance. This will be followed by an intensive literary search for any similar work which may have been carried out, in order to avoid duplication of effort. If a sensor has not been fully explored for a given problem, the Centre will undertake the experiment to determine its suitability or otherwise.

For each problem we will analyze the results obtained from the study of each sensor, determine the level of information provided by each, and identify the differences. The practical value of any additional information provided by one sensor over another will then be studied in order to decide whether the expense of obtaining it is justified. The Centre will then recommend which sensor should be used for each type of problem in order to obtain the required information efficiently and economically.

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AIM OF THE PROPOSAL

Upon completion of the investigations, the Centre is planning to prepare and publish a reference book containing the conclusions reached. This will be entitled: "Applied Remote Sensing in Environmental Impact Assessments".

DURATION

It is anticipated that the investigatory aspects of this proposal and the manuscript of the book will be completed within three years, with open files available for use as information is compiled. Publication of the book will be effected during the fourth year.

COST

YEAR I

One man-year - Environmental Specialist	$ 30,000.
½-man-year Civil Engineer	20,000.
2 man-years Graduate Students or new graduates	30,000.
Consultants' Services	30,000.
Data Acquisition	20,000.
Supplies and Travel Expenses	10,000.
	$140,000.
Contingencies - approximately 10%	15,000.
C/F:	$155,000.

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	B/f:	$155,000.
YEAR II		
The same as Year I with a 10% estimated increase		170,500.
YEAR III		
The same as Year II with a 10% estimated increase -	$187,500.	
Preparation of Manuscript -	25,000.	
Publication Costs -	50,000.	262,500.
	TOTAL:	$588,000.

FACILITIES AT OCRS

The Ontario Centre for Remote Sensing is the leading centre in Canada in applied remote sensing research. Its objective is to identify possible applicational uses for the newly-developed remote sensing technology and develop and establish operational procedures therefor.

Since its establishment in 1972, the Centre has undertaken over 300 projects incorporating the use of available sensors and related technology. The team of scientists at the Centre includes specialists in Geology, Geography, Civil Engineering, Forestry, Hydrology, Geomorphology, Soil Science and Biology. Some specialize in the application of certain sensors such as thermal and radar.

The Centre has the most developed and best equipped operationally-oriented remote sensing laboratory in Canada. Its equipment includes:

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A Digital Image Analysis System

An Electro-Optical Image Analysis System

Daedalus Thermal Line Scanner and Processor

Multi-spectral Photographic Facilities

APPLICON Colour Plotter

Video Imaging System

In addition, the Centre has a Remote Sensing Airborne Program which has exclusive use of a twin-engined aircraft.

Information concerning the activities of the Centre is contained in the attached copy of the OCRS Annual Review 1979-80.

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Study outline : "remote sensing for the ministry of the environment" /

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